A

DETAILED ACCOUNT

OF

EXPERIMENTS AND OBSERVATIONS

UPON THE

SORGHUM SACCHARATUM

OR

CHINESE SUGAR CANE,

MADE WITH THE

VIEW OF DETERMINING ITS VALUE AS A SUGAR PRODUCING PLANT,

FROM SEPTEBER 28, TO DECEMBER 20, 1857,

AT OAKHILL, PHILADELPHIA COUNTY, PA.,

BY JOSEPH S. LOVERING.

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The introduction of this plant into the United States, and the hope of producing sugar from it at the North, profitably, have excited such universal interest, that it has this year been planted in almost every State in the Union; and as the season has advanced, the opinions early expressed by many intelligent and scientific experimentalists, that it contains no crystallisable sugar, have apparently been confirmed by later trials. A few crystals, it is true, have been obtained in one or two instances, but all hope of producing sugar from it profitably seems to have been abandoned.

My object in making the following experiments has been to throw what light I could upon this important question, and, in the event of the result proving favor-

able, to give such a formula as would enable the uninitiated to proceed with confidence of success. They have been pursued without any attempt at extraordinary production, either in the cultivation of the cane or the development of its properties; on the contrary, the experiments were made upon small quantities, under many disadvantages that would not occur in large operations, and consequently with results less favorable.

The series being completed, perhaps the best method of communicating the results and imparting the knowledge obtained, to the public, will be by giving the following extracts from my notes, made as the work proceeded. They will show the progress of the development of the sugar in the stalk, and its decline, with many other interesting facts.

EXTRACTS.

On the 10th of May, I planted about half an acre, on upland of good quality, such as would yield, in ordinary seasons, 50 to 60 bushels Indian corn to the acre. The rows 4 feet apart, and the plants intended to be 6 inches apart in the rows, but which, on taking off the crop, proved to be a little over 7 inches apart. When the canes were about 18 inches in height I had the suckers removed. During the month of June I passed the hoe-harrow through it twice, a man following with the hand hoe, as in the case of Indian corn. It was then left to take care of itself. It grew rapidly and evenly, and attained the height of 12 to 14 feet.

My apparatus and utensils for conducting the experiments consisted of the following, viz:

A pair of iron rollers, 7 inches diameter and 12 inches long, set in a frame $\frac{1}{8}$ of an inch apart, with spout to catch and collect the juice, and a crank turned by hand—a few sugar moulds and pots, some ivory black or animal carbon; two filters, made of common bed ticking, in the shape of an elongated pudding bag; a thermometer, Beaumé's Pèse-Sirop or saccharometer, and a polariscope. All the other utensils I obtained from the kitchen, viz: a copper kettle of 10 gallons capacity, a ladle, some tin pans, bowls, buckets, &c., to contain the juice.

FIRST POLARISCOPIC OBSERVATION.

Sept. 28, Temperature noon, 71° F. Wind S. W. Clear.

Of two canes took the first joints above the stay roots—

1st joint, 9 inches long, weighed, - -	118.854	grammes.
2d " 8 " " " - -	93.742	"
Weight of 1st joints of two canes,	212.596	"
After passing these three times through the rollers, the bagasse weighed	64.380	"
Leaving, as weight of juice, (69.7 per cent.,)	148.216	"
Measured the juice, and found 135 fluid grammes—specific gravity,	1.063	

After precipitation by basic acetate of lead, of a voluminous green colored flocculent substance, it filtered with difficulty, then completed the decolorization by passing it through animal carbon, and found by first observation in polariscope,

A deflection of the ray, right, 27°		
Add 10 p. ct. for dilution by precipitant, 2.7°	29.7 right.	
After inversion by H.Cl. left, 12.0°		
Add 10 p. ct., as above, 1.2°	temperature 27°, 13.2 left.	
Sum of inversion,	42.9	

This sum of inversion, (42.9) at temperature 27°, indicates 54.35 grammes of pure dry sugar to the litre

of juice, and by reference to past results it is found that 204.24 grammes of sugar per litre, equal 18.82 grammes per 100, or 18.82 per ct. Then, as 204.24 : 18.82 :: 54.35 : 5.008 per ct. of sugar in the juice, and as 100 : 5.008 :: 69.7 : 3.49 per ct. of sugar in the cane. A second observation in polariscope, of the juice from the two joints of the same canes next above these, indicated 5.57 per ct. of sugar in the juice, proving them to be richer than those nearer the ground.

FIRST PRACTICAL EXPERIMENT.

Sept. 30. Temp. 8 A. M. 40°, M. 66°. The fact of the presence of crystallizable sugar in the cane being established, I proceeded to cut and grind 20 feet of a row, and passed the 30 canes which it produced three times through the rollers; about one-fourth of the seed had changed to a dark glistening brown color, but was still milky; the remainder was quite green; ground 6 to 8 of the lower joints, which together yielded 3½ gallons of juice, weighing 9° Beaumé; neutralized the free acid by adding milk of lime; clarified with eggs and boiled it down to 240° F.

This first experiment looked discouraging and unpromising at every step; its product was a very dark, thick, viscid mass, apparently a caput mortuum;

it stood six days without the sign of a crystal, when it was placed over a flue and kept warm four days longer, when I found a pretty good crop of soft crystals, the whole very similar to the "Melada," obtained from Cuba, but of darker color.

SECOND EXPERIMENT.

Oct. 13, Temp. 8 A. M. 50°, M. 72°. S. E. cloudy

About two weeks having elapsed since the first experiment, the weather in the interim having been quite warm, temperature at 8 A. M. 40° to 52°, and at noon 66° to 75° F.; and about one half the seed being ripe, I determined to try it again, but not being very sanguine of success, no polariscopic observation was taken.

Cut and ground 50 feet of a row, which produced 88 canes, and yielded 8 gallons of juice, weighing 10° Beaumé, (one degree more than the previous cutting) from the 6 and 7 lower joints; juice slightly acid. 1st. clarification $4\frac{3}{4}$ gallons, neutralized with 3 tablespoonsful of milk of lime, stirred in 1 lb. fine bone black and 3 eggs, and placed it over a slow fire; at 215° F. took off a very dense, thick, green scum; when at 162° F. it marked $7\frac{1}{2}$° Beaumé.

A second parcel of juice from this grinding ($3\frac{1}{4}$

gallons) was treated in the same manner, and set aside, both having been first boiled down to 22° Beaumé.

Oct. 14, Temp. 8 A. M. 54°, noon 70°. N. W clear.

Cut and ground 50 feet; 81 canes, produced 7¼ gallons juice, 10° Beaumé, which was treated as above, except that the eggs were omitted.

Oct. 15 Temp. 8 A. M. 50°, noon 70°. N. E., heavy rain.

Cut and ground 50 feet, produced 8¼ gallons juice, weighing 10° B.

Oct. 16, Temp. 8 A. M. 46°, noon 60°. N. W. stormy.

Cut and ground 50 feet, 86 canes, 8⅔ gallons, 10° B.

The whole of the foregoing four parcels were at this stage of the process concentrated to 22° Beaumé, and set aside until I had completed the series on the 21st Oct.; they were then collected together, and again clarified with eggs, and a second scum taken off; they were then again placed over the fire, and when at the temperature of 225 F., clear lime water in small quantities was added to coagulate the vegetable albumen, which is not disengaged at a lower temperature, but which is then observed as a whitish scum, very tenacious and glutinous, and is very detrimental to crystallization. After the various delays, heatings and re-heatings consequent on my limited means of working, (the great disadvantage of which, those acquainted with the subject only can appreciate) I commenced filtering the whole, but found it so ropy and glutinous

that it would not pass through; diluted it to 10° B., when it came through tolerably bright; then passed it through 5 feet of animal black; it parted with its coloring matter very freely.

Oct. 22d. Temp. 8 A. M. 32°, noon 50°. S. W. clear. Divided the product into three parts, and boiled it as follows:

1st part to 230° F.—This stood an hour without crystallizing—found it too low, although the thumb and finger proof indicated otherwise.

2d. part to 246° F.—which was added to the first, and in a few minutes crystals began to appear.

3d. part to 238°—being the mean of the other two. On finishing this, the two preceding had formed a thick, opaque mass of good crystals.

Filled one mould, wt. 20 lbs.		
Weight of mould,	$4\frac{3}{4}$	
		net weight $15\frac{1}{4}$ lbs.
Filled one mould,	$14\frac{1}{2}$ lbs.	
Mould, - -	$4\frac{1}{2}$	
		" " 10 lbs.
Total net weight,		$25\frac{1}{4}$ lbs.

and next morning set them on pots to drain. Also boiled down the juice from the tops, $4\frac{3}{4}$ gallons, which produced with the scums $13\frac{1}{2}$ lbs. molasses.

Nov. 2d, Temp. 8 A. M. 45°. noon 60°. S. W. Clear.

Knocked out the proceeds of this experiment with the following results, viz:

1 mould, gross weight, 20 lbs.
tare, $4\frac{3}{4}$ " nt. wt. $15\frac{1}{4}$

	Sugar.	Molasses.
weight of molasses,	$8\frac{1}{4}$ nt. wt. 7 lbs.	$8\frac{1}{4}$ lbs.

1 " gross weight, $14\frac{1}{2}$ lbs.
tare, $4\frac{1}{2}$ nt. wt. 10 lbs.

weight of molasses,	$5\frac{1}{2}$ nt. wt. $4\frac{1}{2}$ lbs.	$5\frac{1}{2}$ lbs.
Add molasses made from the tops, as above,		$13\frac{1}{2}$
Total weight of product of 200 feet of a row, lbs.	11.50	27.25
Fifty rows, 4 feet apart and 218 feet long, constitute an acre, and 200 feet of a row is less than 1-50th part of an acre by 18 feet, therefore add pro rata,	1.03	2.45
Product of 1-50th part of an acre in lbs.,	12.53	29.70
Multiply by	50	50
Product of an acre in lbs.,	625.50	1485.00

A gallon of molasses weighs 12 pounds, therefore, divide 1485 by 12, and we have, gallons, 123.75.

For the acre $625\frac{1}{2}$ lbs. sugar, and $123\frac{3}{4}$ gallons molasses, produced from 18,148 canes, yielding 1,737 gallons juice, weighing 9 lbs. per gallon, or 15,633 lbs., being 4 per ct. of sugar and 9.50 per ct. of molasses, or 13.50 per ct. together.

This sugar is of a yellowish brown color, about as dry as, and about the color of 2d quality Cuba sugar, such as is used by refiners. (See sample No. 2.)

THIRD EXPERIMENT.

Oct. 23, Temp. 8 A. M. 36°. M, 55°. Foggy.

The foregoing favorable progress induced me to make another trial, on a larger scale. The weather looked threatening, and as a precaution, I cut 500 feet of canes and stored it in the barn, to be used in quantities conforming to my means of working.

Nearly a month having elapsed since the first polariscopic observation was taken, and two weeks since the second practical experiment—having had several heavy white frosts, and three nights of ice $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in thickness—I concluded to have another examination by polarized light, to see the effect of these changes, when I was gratified to find the following results—juice weighing full 10° Beaumé:

First observation, right,	55°		
Add 10 per ct. for dilution,	5.5°		60.5° right.
After inversion,	2°	temperature 25°	2.2° left.
Add 10 per ct. as above,	0.2°		
Sum of inversion,			62.7°

This sum of inversion, (62.7,) at temperature 25°, indicated 79.06 grammes of sugar per litre of juice—then,

As 204.24 : 18.82 :: 79.06 : 7.29 per ct. of sugar in the juice.

		Feet.	Canes.	Galls. juice.	
Oct. 24, Temp. 8 A. M. 54°, noon 60°. Fog and rain.	Ground	100	160	18¾	10° B.
Oct. 26, Temp. 50°–60° Heavy rain.	"	100	159	18½	10° B.
Oct. 27, Temp. 46°–52° Very stormy.	"	100	166	18 1-16	10° B.
Oct. 28. Temp. 40°–52° Cloudy, N. W.	"	100	149	16⅜	10° B.
Oct. 29. Temp. 43°–48° Clear, N. E.	"	100	148	14⅞	10° B.

These several parcels were clarified like the second experiment, boiled to 15° and 18° B., and set aside till Nov. 2d, when I found all but the last day's work had changed to a thick, liver like mass, resembling good soft soap—very acid and totally ruined. The last parcel, having stood a much shorter time than the rest, was but partially affected. It was boiled to proof, and crystalized very well.

I regret this misfortune less for the trouble it cost me than for the failure of the experiment, for it worked beautifully in the first stages, and the last grinding crystalized freely. The juice weighed heavier than previous or subsequent parcels, and would probably have produced better results. It taught me, however, the danger of delay, and also that no injury had

been sustained by the juice so long as the canes remained unground, the last parcel having crystalized perfectly.

FOURTH EXPERIMENT.

Nov. 2. Temp. 38°–50° N. E. clear. Since the 28th October, the weather has been mild and foggy, with heavy rains; temp. varying from 48° to 60°. A very decidedly increased development of sugar in the juice has been ascertained, viz: 7.29 per ct., instead of 5 per ct., and I have gained some experience; so, instead of allowing the syrup to remain from four to twelve days, still containing a great portion of its fermentable impurities, gradually undergoing decomposition and depreciation, I remedy this evil to some extent, as will be seen. I also dispense with the fine ivory black and the filtering, thus simplifying the process.

Nov. 2. Temp. 38°–50° N. E. clear Cut and ground 58 feet of a row—100 canes—the upper portions of the stalks turning yellow—leaves dead and dry—ground 6 and 7 of the lower joints—produced 10 gallons juice, weighing 10° B., much less acid than previous samples, and barely changing litmus paper—neutralized with milk of lime, and clarified at once perfectly with eggs—passed it immediately through 3½ feet black, and boiled it to 234° F.; after standing an hour the crystals were large and sharp, but not very abundant till morning, it being boiled too low.

Nov. 4. Temp. 31°–50° Ice. Cut and ground 58 feet—100 canes—9 $\frac{5}{16}$ gallons—10° Beaumé—rather more acid than the last—clarified it fully as above—passed it through 5 feet Black, and set it aside, as it is clear and bright, and contains no feculent matter.

Nov. 5. Temp. 34°–62° S. W. Cut and ground 58 feet—94 canes—9$\frac{3}{4}$ gallons, 10° Beaumé—treated as above, and set it aside.

Nov. 6. Temp. 50°–62° S. cloudy. Weather changing—cut and ground 58 feet—95 canes—9$\frac{5}{8}$ gallons, 10° B.—treated as above—also ground the tops of all the above 232 feet, which produced 4 gallons, 2 quarts, and 3 half pints of juice, weighing 12° B.—more acid than the lower joints—treated it the same—boiled it to 238° F. and set it aside. In the morning I found a good crop of crystals, but the mass thick and viscid—added 3 tablespoonfulls clear lime-water, heated it to enable me to pour it into a mould—gross weight 9$\frac{1}{2}$ lbs., tare 4$\frac{1}{2}$ lbs., net 5 lbs. On the 13th knocked it out and had 3 lbs. good brown sugar, and 2 lbs. molasses.

Nov. 7. Temp. 54°–66° South. Boiled one-half of the remainder of the proceeds of the above lower joints, (one-third of the whole having been boiled on the 2d, as above stated) to 236° F., and added it to that boiled on the 2d—boiled the other half to 237° F.—potted it at 176° F. very handsomely crystallized, and very light colored.

Nov 8. Temp. 60°–74° S. W. Withdrew the stops and set it on pots to drain.

Nov. 9. Temp. 34°-50° S. W. The full mould (15 lbs. size) had run $1\frac{1}{8}$ gallons molasses, or syrup—if it had been boiled a little higher it would have produced more sugar, and less molasses.

Nov. 14. Temp. 30°-42° N. E. ice. The whole having now stood 7 days, and being thoroughly drained, weighed as follows:

1 small mould, 10 lbs.
Tare, $4\frac{1}{2}$
— nt. wt. sug., $5\frac{1}{2}$ lbs.
1 larger, " $18\frac{1}{4}$
Tare, 7
— " " $11\frac{1}{4}$
Sugar from the tops, - 3

Product of 232 feet canes,	19.75 lbs.	
1 pot molasses, 17 lbs., tare 5 lbs.		12 lbs. nt.
1 " " 9 " 5		4
1 " " $12\frac{1}{4}$ " 5		7.25
Molasses from the tops,		2
Product of molasses from 232 feet canes, - - - - -		25.25
232 feet are more than $\frac{1}{50}$th part of an acre by 14 feet, therefore deduct pro rata, - -	1.19	1.52
Product of $\frac{1}{50}$th part of an acre,	18.56	23.73
Multiply by - - - - -	50	50
Product of an acre in lbs., -	928.00	1186.50
A gallon of molasses weighs 12 lbs., therefore divide by 12 for gallons, -		98.87

and we have 928 lbs. sugar (first returns) and 98.87

gallons molasses, made from one acre (18.277) of canes, which produced 1847 gallons juice, weighing at 9 lbs. per gallon, (16.623 lbs.,) or, sugar, first crop, 5.58 per cent.—molasses, 7.14 per cent.—together, 12.72 per cent.*

This sugar is perfectly dry, as shown by sample No. 4, it worked perfectly, and without the slightest difficulty, at every stage.

Nov. 17. Temp. 34°–48° N. W. Boiled all the molasses from the above (except the two lbs. from the tops which was too poor for re-crystallization) 23.25 lbs.—added clear lime water until it marked 35° B. when boiling—took off a thick, glutinous scum, and boiled it down to 243° F.—in two hours it produced a copious crop of very good crystals—allowed it to stand till morning, when it was quite solid.

Dec. 18. Temp. 30°–52° S. E. Here an unfortunate accident occurred. Having placed the crystalized mass over a slow fire, to render it fluid enough to cast into a mould, I was called off to a case of illness, leaving it over the fire, and being detained much longer than I anticipated, on returning I found all the grain melted and

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* Neither the scales in which this juice was weighed, nor the quart measure in which it was measured were sufficiently delicate or accurate to give precise results, and as they form the basis of these calculations, the per centages are probably not absolutely exact, but they are sufficiently so for all practical purposes.

the molasses boiling vehemently, and badly burned. Much discouraged, I however proceeded. It crystalized the second time, and was put into a mould.

December 20. Weighed the sugar from the 23.25 lbs. molasses boiled on the 17th Nov., as follows, viz:

Gross weight, - - - - -	11 lbs.
tare, - - - - - -	$4\frac{3}{4}$
Second crop of crystals from the 23.25 lbs. molasses, - - - - - -	6.25 lbs.
Deduct pro rata for the 14 ft. excess over $\frac{1}{50}$ of an acre, - - - - -	.373
Second returns from $\frac{1}{50}$ of an acre, - -	5.877
Multiply by - - - - - -	50
Product of an acre from the molasses, -	293.85

Then we have, as the whole final result of an acre of canes,

	Sugar.	Molasses.
1st returns, - - -	928 lbs.	1186.50 lbs.
2d " (Sample IV.)	293.85	
And deduct molasses converted,		293.85
	1221.85	892.65
And 12 lbs. molasses per gallon gives		74.39 gal.

Say sugar, per acre, 1221.85 lbs.; molasses, per

acre, 74.39 gallons; sugar, per ct., 7.35;* molasses, per ct., 5.37; sugar and molasses, 12.72 per ct.

I will repeat here, that owing to the accident before stated, this sugar, (Sample No. IV,) 2d returns, is not nearly of so good quality as it otherwise would have been.

FIFTH EXPERIMENT.

November 9. I must now mention that the last experiment was intended to have been on a considerably larger scale than those previous. Each day's work was, however, kept distinct and separate from the others, thus enabling me to determine it at any point.

Having thus proceeded to, and finished the clarification of the 4th parcel, (Nov. 8th,) and the weather becoming and continuing very warm, (thermo. as high as 74°,) I observed a very sudden and unfavorable change in the working of the juice. Instead of clarifying perfectly and with great facility, as at first,

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* It may, perhaps, appear inconsistent to the casual observer, to find 7.35 per ct. of sugar obtained, when the juice only contained 7.29 per ct., as shown by the polariscope. This is readily explained. 1st. By the causes stated in a previous note; and 2d,—the polariscope indicates pure sugar; whereas the sugar produced contains about 4 per ct. free moisture, and about 3 per ct. of molasses adhering to the crystals, also gum, &c., which would account for much more than the apparent excess.

the defecation was difficult, the color many shades darker, the juice gradually fell off in weight from full 10° B. to 9° B., and required 10 ft. of granulated black to bring it to the same color as that made six days previously with 5 ft. black. I however proceeded (keeping this separate) to the crystallization.

Boiled it to 242° F., when it produced good, hard, sharp crystals; but finding the quantity, by measurement, had decreased very considerably, I took no further note on that head, but gave it white liquor until it was neat, (about the usual quantity,) and produced the sugar, (sample No. 5,) being white sugar, directly from the cane, without refining or re-melting.

SIXTH EXPERIMENT.

November 27. Since the canes for the 4th and most successful experiment were cut, on the the 6th inst., the weather has been very changeable. We have had warm Indian summer weather, with heavy rains, also very cold weather, making ice two inches in thickness—thermometer having varied from 16° to 60°. To try the effect of these changes, I cut $\frac{1}{100}$ part of an acre, which produced $11\frac{5}{16}$ gallons of juice only, instead of 19 or 20 gallons, as before. It had, however, regained its former weight of full 10° B., but was much more acid, rank and dark colored than pre-

viously. It clarified without difficulty, but raised a much thicker and denser scum, and, when concentrated, was very dark and molasses-like; it, however, produced good, hard, sharp crystals, but the quantity being much reduced, there was no inducement to pursue it further. This experiment proves, however, that this cane will withstand very great vicissitudes of weather, without the entire destruction of its saccharine properties.

SEVENTH EXPERIMENT.

Took the proceeds of the experiments that were considered failures, viz., all the 3d and the poorest portion of the 2d, viz.: 34 lbs. very indifferent sugar—refined it in the open kettle, by the old process, and produced 15 lbs loaf sugar, (sample No. 7,) which is a very full yield for the quality used.

The foregoing are all actual results produced by myself, (the polariscopic observations having been taken on the spot, under the supervision of my partner, Mr. William Morris Davis) with no object in view but the truth, and a desire to contribute whatever useful information I could towards the solution of this

interesting and important question. They are, I think, sufficiently flattering in themselves to warrant renewed exertions on the part of our agriculturists of the northern and middle States especially, and perhaps those of the South also, in the pursuit of this promising branch of industry, to the full and profitable development of which it is certainly capable, and which it is destined ultimately to attain—(as before mentioned they have been accomplished without the advantages of the powerful sugar mill—the vacuum pan and the many other improved implements and apparatus now in general use in Louisiana and elsewhere) and they are also important and interesting in many respects, not apparent to those unacquainted with the subject; it may therefore not be superfluous to make some further explanatory remarks:

1st. The mill used and the power employed in these experiments were much less efficient than those in general use on sugar plantations, and the waste proportionally greater—the loss from which causes I estimate at not less than 10 per cent.

2d. It is well known to all who are acquainted with sugar and saccharine solutions, that by frequent heatings and coolings, a considerable portion of the crystallizable, is converted into uncrystallizable sugar, and is consequently lost as sugar—in these experiments every parcel was from necessity heated and re-heated from 8 to 12 different times.

3d. It is impossible to produce as good results, whether as regards quantity or quality from small, as from large quantities.

4. This sugar, (sample No. 4) is quite dry, and will lose comparatively nothing by drainage; the yield would be considerably greater, if it contained the usual quantity of footing that is contained in the hogshead when sold at the plantation—one of which being weighed there and re-weighed in Philadelphia, in the month of July, will be found to have lost by drainage from 100 to 150 lbs., or from 10 to 15 per cent.

Assuming these propositions to be true, I make the following estimate of the probable yield of an acre of canes of ordinary growth, such as I have experimented upon, viz.:

Actual yield as per Experiment No. 4,		1221.85 lbs. sugar, 74.39 molasses.
Add for inefficiency of mill,	10 p. c.	
For heating and re-heating, &c.,	5	
For footings, say but*	5	
	20 p. c.	244.37
Probable yield per acre,		lbs., 1466.22 sug, galls. 74.39 molasses.

Further, it will be observed that my acre produced but 1847 gallons of juice—I have, however, seen published

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* These two latter gains in sugar would be made at the expense of the molasses, taking from it the gain which would be realized by the use of a better mill, and therefore leaving the quantity of molasses unchanged.

accounts of far greater yield than this—one for instance in this county, apparently well authenticated, reaching 6.800 gallons per acre, which, according to my *actual* results, would produce 4499 lbs. of sugar, and 274 gallons molasses—and according to the foregoing *probable* results, would yield 5389 lbs. sugar, and 274 gallons to the acre. I do not pronounce such yield of juice impossible, but it will certainly be of rare occurrence—a mean between this and my yield would be a large return.

Another subject worthy of notice, is the nature of the season. My impression is, that owing to the lateness and coldness of the spring, and the continued wet weather, the last has been quite an unfavorable season for the ripening and development of the sugar in the juice, to which cause I think a deficiency in the yield of at least 10 per cent. may be attributed, which would further increase the quantity to 1,612 lbs. of sugar, and $81\frac{8}{10}$ gallons molasses, a yield very nearly corresponding with that of the best conducted plantations of Louisiana, as will be seen by the following figures, which I have collated from a minute statement furnished to me by the enterprising proprietor of one of the most complete and costly establishments in that region, (it being furnished with vacuum pans, and all the most approved machinery of latter times, and conducted under his own personal supervision,) of the actual product of one of his plantations of 266 acres,

for eight consecutive years. These figures will also furnish useful data for the estimation of the cost of production here, viz:

Aggregate yield of juice from 266 acres for 8 consecutive years, - - - 4,757,700 gallons.
Aggregate yield of sugar, - 3,626,425 lbs.
" " molasses, - 217,585 gallons.

COMPARISON.

LOUISIANA.	PENNSYLVANIA.
Yield of juice per acre, 2,236 gals.	.....1,847 gals.
Density of juice, (Beaumé) 8.44°	.....10°
Yield of sugar per gal. of juice,.....0.76 lbs.	.....0.66 lbs.
Yield of sugar per acre,....1,704 "	Actual,.... 1,221.85 lbs. Probable,..1,612.00
Yield of molasses per acre,...102 gals.	Actual,..... 74.39 gals. Probable,..... 81.83
Wood consumed per acre, 3.87 cords, at $2 50 per cord.	
Coal for engine, 0.41 tons, at $2 50 per ton.	
Labor, per acre, 3.70 days.	

These details have been extended to a much greater length than was at first intended, but perhaps not beyond a useful limit for those interested. To the working farmer they may appear formidable and prolix, but he may, nevertheless, gain some grains of useful knowledge from them to repay for their peru-

sal. The conclusions to be drawn from them will be seen by the following

SYNOPSIS.

1st. That it is obvious that there is a culminating point in the development of the sugar in the cane, which is the best time for sugar making. This point or season I consider to be, when most if not all the seeds are ripe, and after several frosts, say when the temperature falls to 25° or 30° F.

2d. That frost, or even hard freezing, does not injure the juice nor the sugar, but that warm Indian summer weather, after the frost and hard freezing, does injure them very materially, and reduces both quantity and quality.

3d. That if the cane is cut and housed, or shocked in the field when in its most favorable condition, it will probably keep unchanged for a long time.

4th. That when the juice is obtained the process should proceed continuously and without delay.

5th. That the clarification should be as perfect as possible by the time the density reaches 15° Beaumé, the syrup having the appearance of good brandy.

6th. That although eggs were used in these small experiments, on account of their convenience, bullock's blood, if to be had, is equally good, and the milk of

lime alone will answer the purpose; in the latter case, however, more constant and prolonged skimming will be required to produce a perfect clarification, which is highly important.

7th. That the concentration, or boiling down, after clarification, should be as rapid as possible without scorching—shallow evaporators being the best.

With these conditions secured, it is about as easy to make good sugar from the Chinese cane as to make a pot of good mush, and much easier than to make a kettle of good apple-butter.